

Reaching 90% Compliance: Maryland Building Code Compliance Roadmap

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Table of Contents

Acronyms..... 1

Introduction..... 3

The Importance of Adopting a Strong Energy Code 3

 Impacts on other Maryland Initiatives 4

Federal Role in 90% Compliance..... 5

The Federal Requirements/Guidelines for Measuring Compliance..... 7

Maryland’s Recent Code Activity..... 9

Maryland Energy Code Compliance Background.....11

County and Municipality Code Official Interviews14

Stakeholder Working Group23

Annual Self-Assessment.....26

Findings and Recommendations.....27

 Finding #127

 Recommendation #128

 Finding #228

 Recommendation #228

 Finding #328

 Recommendation #329

 Finding #430

 Recommendation #430

 Finding #530

 Recommendation #530

 Finding #630

 Recommendation #630

 Finding #730

 Recommendation #731

Appendix A – Stakeholder Working Group Meeting Minutes32

Appendix B – Letter from the Governor.....37

Appendix C – Code Official Interview Guide.....45

Acronyms

ACEEE - The American Council for an Energy-Efficient Economy
AIA – American Institute of Architects
ARRA – American Recovery and Reinvestment Act of 2009
ASHRAE – American Society of Heating, Refrigerating, and Air-conditioning Engineers
BCAP – Building Codes Assistance Project
BECF – Building Energy Codes Program
DHCD – Department of Housing and Community Development
DOE – U.S. Department of Energy
FCBA – Frederick County Builders Association
IBC – International Building Code
ICC – International Code Council
IECC – International Energy Conservation Code
IRC – International Residential Code
MBOA – Maryland Building Officials Association
MBPS – Maryland Building Performance Standard
MDIA – Middle Department Inspection Agency
MEA - Maryland Energy Administration
MNCBIA – Maryland National Capital Building Industry Association
PNNL – Pacific Northwest National Laboratory

Introduction

Since 2009 Maryland received more than \$50 million in federal funding through the Federal State Energy Program (SEP) for energy projects within the state. This federal largesse has been fairly evenly distributed throughout the state to both local governments and private citizens alike for projects ranging from insulating government buildings in small towns to adding solar panels to private homes. One of the few requirements for accepting these funds was that the state adopt the most recently published International Energy Conservation Code (IECC) and prove compliance with the adopted code by 2017. In 2009, Governor O'Malley acted on behalf of the state and accepted this provision. In that same year, legislation was passed mandating that the state adopt the most recently published edition of the IECC within one year. Maryland adopted the IECC 2012 in January of 2012 and localities were expected to adopt and enforce the same code within six months.

The primary purpose of adopting and complying with a more stringent energy code is to reduce lifetime energy consumption in new construction and extensive remodels. Reduced energy consumption in a new energy efficient building saves money for owners every year that a building exists, paying for any added construction costs many times over. This Plan, which is a collaborative effort between state agencies, local building officials, private firms, and other stakeholders, describes a path to reach 90% statewide compliance with the adopted code by 2017. The Plan relies heavily on creating an iterative process of compliance review and targeted training to reach the 90% compliance goal. A sustained effort over the next several years by all stakeholders in the process should make the goal achievable within the allotted time, and will subsequently save Maryland residents millions of dollars in energy costs for years to come.

The Maryland Energy Administration (MEA), as the Governor's energy advisor, is leveraging Maryland's Department of Housing and Community Development's (DHCD) expertise in the field of code compliance to develop a plan that will help localities comply with the most recently adopted IECC. MEA's mission is to assist Maryland citizens and businesses save money through smart investments in energy efficiency, renewable energy and conservation; and improved energy codes are seen as an important part of this mission. In the short term, MEA will oversee the formation of a Codes Compliance Working Group from a wide group of building industry and government stakeholders. Over the next several years, MEA will collaborate with DHCD and the Working Group to develop programs based on this Plan to further the goals of code compliance.

The Impacts of Adopting a Strong Energy Code

According to the U.S. Energy Information Administration's 2010 Annual Energy Review, residential and commercial buildings combined account for 42% of all energy consumed by end-use sectors in the United States; which is more than the share of energy used by either the

transportation or industrial sectors.¹ The implementation of strong energy codes for buildings will, over time, as the building stock overturns, dramatically reduce the amount of energy used in this sector. Adopting and complying with more stringent building codes is one of the few certain means available to reduce the total amount of energy consumption on a state-wide and national basis.

While energy codes only apply to newly constructed or renovated buildings, the savings in energy, energy costs, and greenhouse gas emissions that result from their implementation are significant. According to a fact sheet produced by the Building Codes Assistance Project (BCAP), upgrading from the 2006 IECC to the 2009 IECC will save Maryland homeowners in 2009 IECC compliant homes \$235 per year. The report estimates that these savings levels would result in \$165 million saved annually by 2030. For primary energy savings, the fact sheet estimates 15 trillion Btus saved annually.² Since the 2012 code leads to 30% more efficient buildings than the 2009 code, the savings will be even greater.

The American Council for an Energy-Efficient Economy (ACEEE) ranks states in an annual *State Energy Efficiency Scorecard*. Maryland currently ranks 10th nationally. The *Scorecard* presents a comprehensive ranking of the states based on an array of metrics that capture best practices and recognize leadership in energy efficiency policy and program implementation. These metrics include utility energy efficiency, rebates and tax incentives, building energy code adoption, and transportation efficiency policies. In the building energy code section of the *Scorecard*, Maryland received five out of five total points for its energy code adoption. However, it only received half a point out of two possible points for code compliance. This score was based on what ACEEE described as “limited efforts” in code compliance. In 2011, thirty-one states ranked higher than Maryland in energy code compliance points.³

Given the energy savings potential of the 2009 and 2012 IECC over previous energy codes, as well as the importance allocated to both adoption of and compliance with these energy codes, Maryland has taken an important step in the process of realizing the energy savings potential of its building stock. The next step, the process started by this Plan, is to implement code compliance practices that improve compliance throughout the state so that energy savings are not merely theoretical.

Impacts on other Maryland Initiatives

The consequent decrease in energy consumption resulting from a strong energy code is especially significant for the State of Maryland. In 2008, Governor Martin O’Malley established the EmPOWER Maryland initiative to reduce per capita energy consumption and peak energy

¹ *Annual Energy Review 2010*, U.S. Energy Information Administration, October 2011
<http://www.eia.gov/totalenergy/data/annual/index.cfm>

² *BUILDING CODES & ENERGY EFFICIENCY: MARYLAND*, BCAP, February 27, 2009

³ *2011 State Energy Efficiency Score Card*, ACEEE, 2011, pp v-vii and 39-42.

demand by 15% by 2015, based on 2007 electricity consumption levels.⁴ As a major energy consuming sector, buildings represent a large source of potential savings that can help the state achieve this goal.⁵

The amount of greenhouse gas emissions that can be reduced through the implementation of more efficient building energy codes is substantial. The Maryland Commission on Climate Change published a Climate Action Plan in 2008⁶ that listed more stringent building codes as a key mitigation policy to reduce greenhouse gas emissions from within the state. The main goals of the Plan are to identify how the effects of climate change are likely to affect Maryland and its citizens and what the state can do to reduce greenhouse gas emissions.

Implementing more stringent building energy codes that reduce greenhouse gas emissions will help reduce the negative impacts to the state from a rise in sea-level, shore erosion, coastal flooding, and damaging coastal storms—all attributed to and influenced by greenhouse gas emissions and their impact on climate change. Furthermore, the reduction in greenhouse gas emissions resulting from adopting and complying with more stringent building energy codes can help the state protect its agricultural industry, forestry, and fishery resources from the harmful impacts of climate change.

Federal Role in 90% Compliance

In February 2009, President Obama signed the American Recovery and Reinvestment Act of 2009 to stimulate job creation and promote national economic recovery among a number of other purposes. To accomplish this, the Act included funding for investments that promote advances and efficiencies in areas related to health, science, transportation, environmental protection, and infrastructure.

As part of the effort to stimulate job growth associated with environmental protection, the Act set aside \$3.1 billion in funding for the U.S. Department of Energy (DOE) to issue formula-based grants under the State Energy Program. DOE's State Energy Program provides funding to stimulate energy efficiency in states, and in order to receive program funds states are required to adopt a residential building energy code that meets or exceeds the most recently published International Energy Conservation Code and a commercial building energy code that meets or exceeds ASHRAE Standard 90.1-2007. In addition, states are required to develop a plan to achieve 90% compliance with these codes for new and renovated residential and commercial buildings by February 2017. Maryland received just over \$50 million in funding under the State Energy Program from the 2009 American Recovery and Reinvestment Act, and is subject to

⁴ <http://www.energy.md.gov/facts/empower.html>

⁵ *Annual Energy Review 2010*, U.S. Energy Information Administration, October 2011
<http://www.eia.gov/totalenergy/data/annual/index.cfm>

⁶ http://www.mde.state.md.us/assets/document/air/climatechange/executive_summary.pdf

these requirements. The letter from Maryland accepting federal funding and agreeing to comply with the requirements mentioned above is included in the Appendix.

Governors from all 50 states pledged to meet the 90% compliance target, and there are ongoing efforts across the country to conduct compliance studies. To support these efforts DOE's Pacific Northwest National Laboratory (PNNL) developed a common methodology for assessing compliance.⁷ Documents and resources from PNNL's efforts are referenced in this Plan.

Maryland adopted the 2012 IECC in January 2012 and was the first state in the country to do so. A meeting held with a group of stakeholders in February pointed to some confusion among the participants about whether the state was to test compliance against the 2009 or 2012 code. Subsequent discussions with DOE have clarified that if a state adopts the 2012 code, the state can use compliance with the 2012 code to demonstrate compliance with the 2009 code.

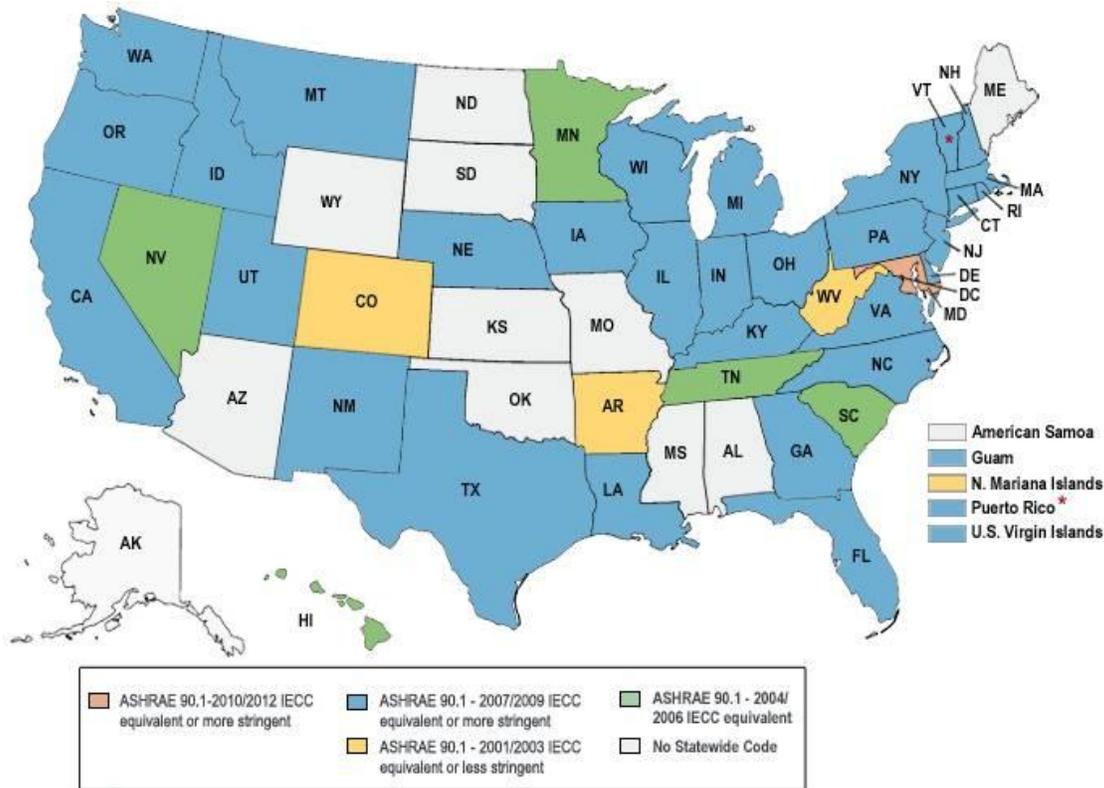
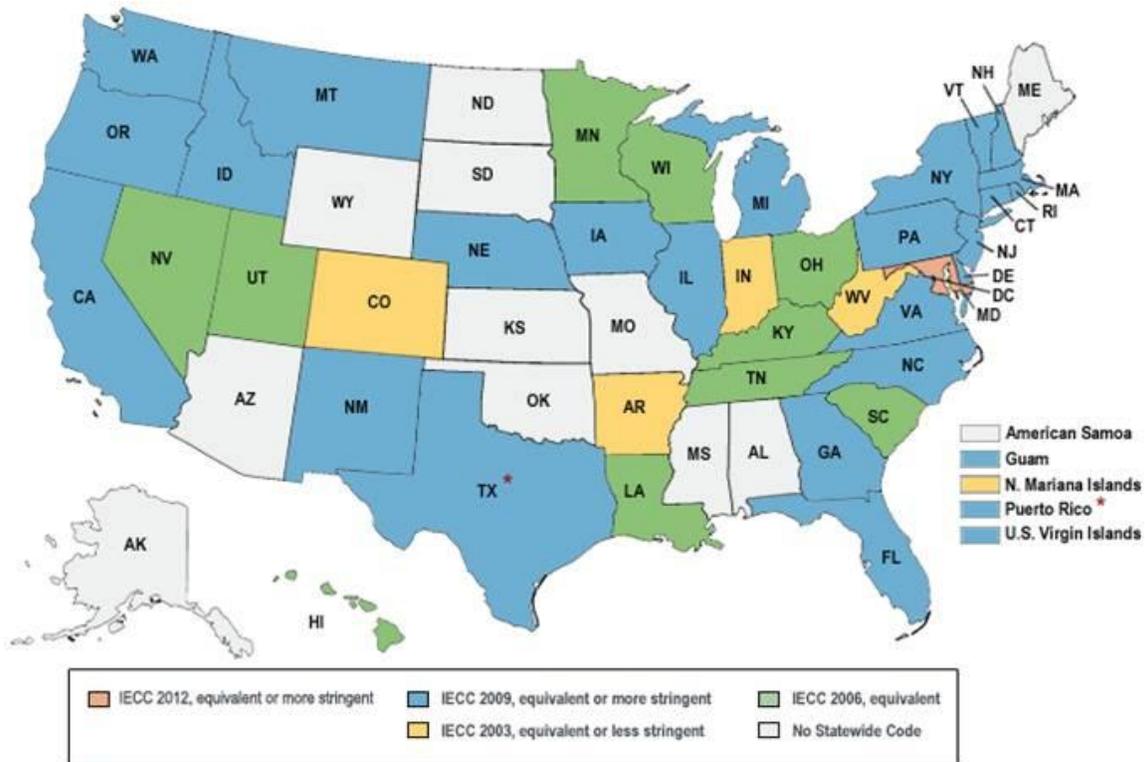


Figure 1. Status of Commercial Code Adoption as of January 2012. Source: DOE

For the commercial code, the 2009 IECC allows compliance by using the ASHRAE 90.1 2007 Standard. In the 2012 IECC, compliance is allowed through reference to the ASHRAE 90.1 2010 Standard.

⁷ <http://www.energycodes.gov/arra/documents/MeasuringStateCompliance.pdf>



* Adopted new Code to be effective at a later date

Figure 2. Status of Residential Code Adoption as of January 2012. Source: DOE

The Federal Requirements/Guidelines for Measuring Compliance

There are two ways to measure the 90% compliance threshold. The first involves evaluating a building to determine whether it passes or fails code requirements. In this approach, in order to document 90% compliance, 90% or more of the buildings evaluated must pass. The second method involves determining the extent to which buildings evaluated are found to be in compliance with the energy code and documenting this on a scale from 0% to 100%. For this methodology, the average level of compliance for tested buildings must be 90% or higher. The State of Maryland is likely to utilize the second option for measuring compliance, although the implications and pros and cons will be further discussed during meetings of the Codes Compliance Working Group.

In addition, DOE recommends that compliance be based on an evaluation of a statistically significant sample of buildings from each of the four building types:

- Residential new construction
- Commercial new construction
- Residential renovations
- Commercial renovations

The compliance results for these four categories will be reported separately. The 90% compliance threshold must be met by 2017, but there will be annual assessments provided in the interim.

In the DOE report, *Measuring State Energy Code Compliance*, a variety of statistical equations for adjusting the state sample number are provided, but at a minimum at least 176 buildings should be sampled with 44 each from the categories identified above. DOE also recommends spreading the sample of buildings across climate zones and counties based on the proportional number of building starts. In Maryland, the majority of buildings sampled would be in climate zone 4 (only Garrett County is climate zone 5) and the sampling would be more heavily weighted to areas with higher construction activity. Areas without much construction activity would be represented at proportional levels. DOE recognizes that in some small or sparsely populated jurisdictions, a representative sample might not be possible. In such a case, building samples could be pulled from multiple, similar jurisdictions.

DOE also recommends that states vary their sample according to building type. In the category of new commercial construction, DOE recommends using an equal distribution of small, medium, and large buildings (as defined in their *Measuring State Energy Code Compliance* report) to account for complexity in energy code requirements. These numbers can be adjusted due to lack of construction in a certain category. However, if X-Large or XX-Large construction is common, these should be added to the sample of 44 rather than replacing smaller building types. DOE also recommends a variety of usage types such as retail, hospitals, office buildings, etc.

In residential construction, DOE recommends spreading the sample across ownership type (rental/owner-occupied, etc.) as well as the following construction types:

- Modular homes
- One- or two-family detached dwellings
- One- or two-family attached dwellings
- Townhouses
- Multifamily apartments
- Multifamily condominiums

For renovations, DOE recommends varying the sample by type of renovation being performed.⁸

⁸ *Measuring State Energy Code Compliance*, Pacific Northwest National Laboratory, Prepared for The US Department of Energy, March 2010

Codes in Maryland

Maryland building codes affecting the minimum requirements for construction of commercial and residential buildings are contained in the Maryland Building Performance Standard (MBPS) which is regularly updated by DHCD's Codes Administration. State legislation in 2009 requires that DHCD adopt the latest version of the International Building Code (IBC), including the IECC, within 12 months after the codes are published by the International Code Council (ICC). The legislation also requires local jurisdictions to adopt and begin enforcing the most recent version of the MBPS no later than six months after the MBPS has been updated by the state.

In Maryland, local jurisdictions enforce building codes and are allowed to adopt the MBPS with local amendments. However, local jurisdictions are prohibited from making amendments to the MBPS that would prohibit the minimum implementation or enforcement activities specified or that would weaken the energy conservation and efficiency provisions contained within the Standard. Maryland Senate Bill 625 contains the following language:

(a) A local jurisdiction may adopt local amendments to the Standards if the local amendments **DO NOT:**

(1) prohibit the minimum implementation and enforcement activities set forth in § 12–505 of this subtitle; or

(2) **WEAKEN ENERGY CONSERVATION AND EFFICIENCY PROVISIONS CONTAINED IN THE STANDARDS.**

The MBPS is enforced locally by all counties and select municipalities throughout the state. As such, counties and municipalities employ code enforcement officials, either on staff or on contract, to review building plans and to perform site inspections to ensure that a newly constructed or renovated building subject to compliance with the MBPS, does in fact comply with the Standard. Code officials from each county were interviewed for this study and the results are contained within this Plan.

As part of the energy code adoption process, Maryland offered training courses focused on the 2009 IECC. Fifteen total trainings were conducted (eight residential training sessions; seven commercial training sessions) between November 15, 2010 and February 23, 2011. These sessions were conducted throughout the state by various trainers. The residential training curriculum was developed by BCAP and delivered by a combination of the National Association of Home Builders Research Center and SRA International. BCAP also used its commercial code curriculum to deliver one commercial training session while ICF International used the same curriculum to deliver two commercial training sessions. The ICC delivered the remaining five commercial sessions using its own curriculum. Figures 6 and 7 describe the training sessions:

COMMERCIAL PROVISIONS OF THE 2009 IECC
WITH HIGHLIGHTS FROM ASHRE STANDARD 90.1.2007

This course will provide an overview of the core concepts of the 2009 International Energy Conservation Code as they apply to commercial buildings along with key aspects of ASHRE Standard 90.1-2007. Through this training, participants will understand how requirements should be met through the building design, construction, and renovation processes and how to evaluate code compliance during plan review and inspection.

OBJECTIVES –

Upon completion of this seminar, participants will be better able to:

Identify the three compliance pathways for commercial buildings and when to apply them

Explain the intent behind air sealing and how it improves energy efficiency in commercial buildings.

Explain the intent of duct insulation, placement, and appropriate duct design for increased energy efficiency in commercial buildings.

Explain the role of envelope insulation and correct material identification and how it relates to increased energy efficiency in commercial buildings.

Identify the principles of air movement through the building envelope and how energy code requirements help prevent unintended air movement.

Navigate the COM check software to determine compliance with ASHRE 90.1-2007 and Chapter 5 of the 2009 IECC.

TRAINING SEMINAR DATES & LOCATIONS

THURSDAY, DECEMBER 2 – GARRETT COUNTY COMMUNITY COLLEGE

THURSDAY, DECEMBER 16 – DHCD, CROWNSVILLE, A.A. COUNTY

WEDNESDAY, JANUARY 5 – SNOW HILL, WORCESTER CO.

WEDNESDAY, JANUARY 26 – HAGERSTOWN, WASHINGTON CO.

WEDNESDAY, FEBRUARY 2 – ABERDEEN, HARFORD CO.,

TUESDAY, FEBRUARY 15 – LEXINGTON PARK, ST. MARYS CO.

WEDNESDAY, FEBRUARY 23 – EASTON, TALBOT CO.

Figure 3. Commercial Training Performed

RESIDENTIAL PROVISIONS OF THE 2009 IECC

This course will provide an overview of the core concepts of the 2009 International Energy Conservation Code (IECC) as they apply to residential buildings. Through this training, participants will understand how key provisions of the code should be applied during building design, construction, and renovation. Also, the participant will learn how to evaluate code compliance during plan review and inspection. Key building science concepts will be presented to help provide participants with a broad understanding of how code requirements relate to energy use. In addition, typical code compliance failures will be highlighted along with strategies for enforcing the provisions that yield the greatest energy savings.

OBJECTIVES –

1. Identify the three compliance pathways for residential buildings outlined in the 2009 IECC and when to apply them.
2. Explain the intent behind air sealing and how it improves energy efficiency for residential buildings.
3. Explain the intent of duct insulation, placement, and appropriate duct design for increased energy efficiency in residential buildings.
4. Explain the roll of envelope insulation and correct material identification and how it relates to increased energy efficiency in residential buildings.
5. Identify the principles of air movement through the building envelope and how energy code requirements help prevent unintended air movement.
6. Navigate the REScheck software to determine compliance with the 2009 IECC.

RESIDENTIAL SEMINARS DATE & LOCATION –

- TUESDAY, NOVEMBER 9 – McHENRY, GARRETT COUNTY
- THURSDAY, NOVEMBER 18 – EASTON, TALBOT COUNTY
- FRIDAY, NOVEMBER 19 – FEDERALSBURG, CAROLINE COUNTY
- TUESDAY, NOVEMBER 30 – LEXINGTON PARK, ST. MARYS CO.
- MONDAY, DECEMBER 6 – DHCD, CROWNSVILLE, A. A. COUNTY
- TUESDAY, DECEMBER 7 – HAGERSTOWN, WASHINGTON COUNTY
- FRIDAY, DECEMBER 10 – SNOW HILL, WORCESTER COUNTY
- TUESDAY, DECEMBER 14 – ABERDEEN, HARFORD COUNTY

Figure 4. Residential Training Performed

The IECC specifies some code requirements by climate zone. As shown in Figure 3, Maryland is predominantly climate zone 4 with Garrett County in climate zone 5. Climate zones impact insulation and fenestration specifications.

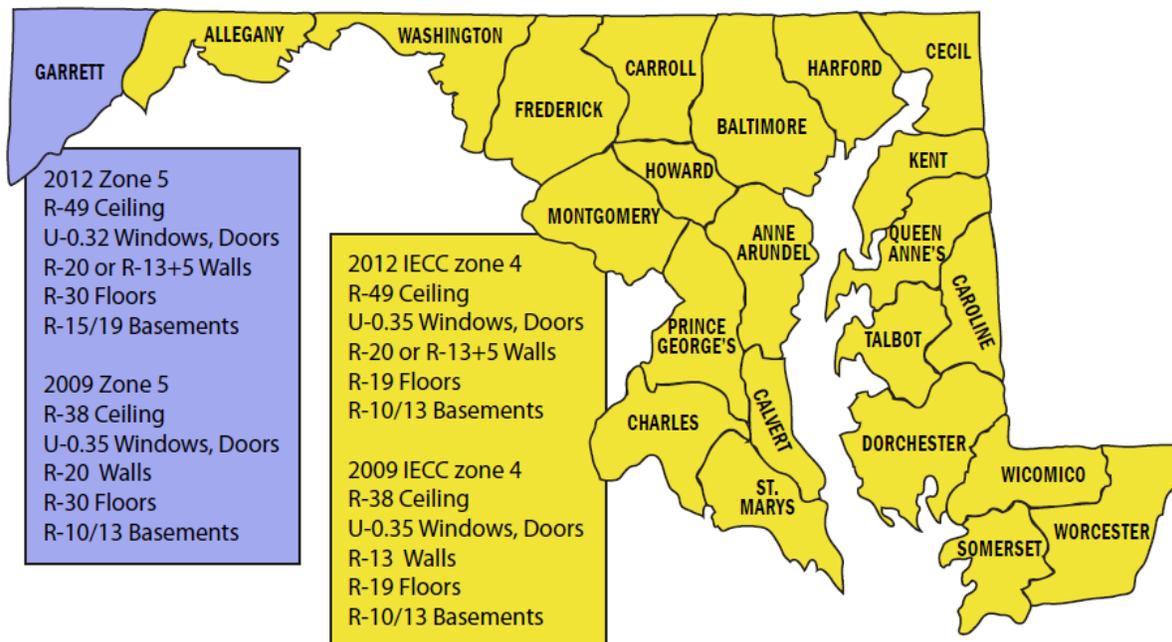


Figure 5. Maryland Climate Zone Map with Residential Code Summary

Both ASHRAE 90.1 and the Commercial Chapter of the IECC contain insulation and fenestration requirements that are impacted by climate zone. In addition, climate zone impacts several HVAC requirements in both of these commercial building codes/standards.

Building Activity in Maryland

Since the energy savings associated with more stringent energy codes is tied to the number of building permits issued in a jurisdiction, it is useful to analyze the number and types of permits issued over an extended time period. In recent years, the number of new residential construction permits issued by jurisdictions in Maryland has declined significantly as compared to the number issued annually between 2001 and 2005 (see figure 1). According to the U.S. Census Bureau, from 2001 to 2005 jurisdictions within the state issued, on average, about 29,000 permits per year for new residential construction. From 2008 to 2010, the amount of permits issued for new home construction was never higher than about 13,000 in a single year.⁹ In addition, according to quarterly data provided by the Maryland State Data Center,¹⁰ jurisdictions within the state issued approximately 11,500 permits for new residential

⁹ <http://www.census.gov/construction/bps/>

¹⁰ <http://www.mdp.state.md.us/msdc/NewHH/newhh.shtml>

construction in 2011. Although housing starts have decreased, the numbers still represent a significant number of buildings impacted by energy efficiency code requirements adopted by the state.

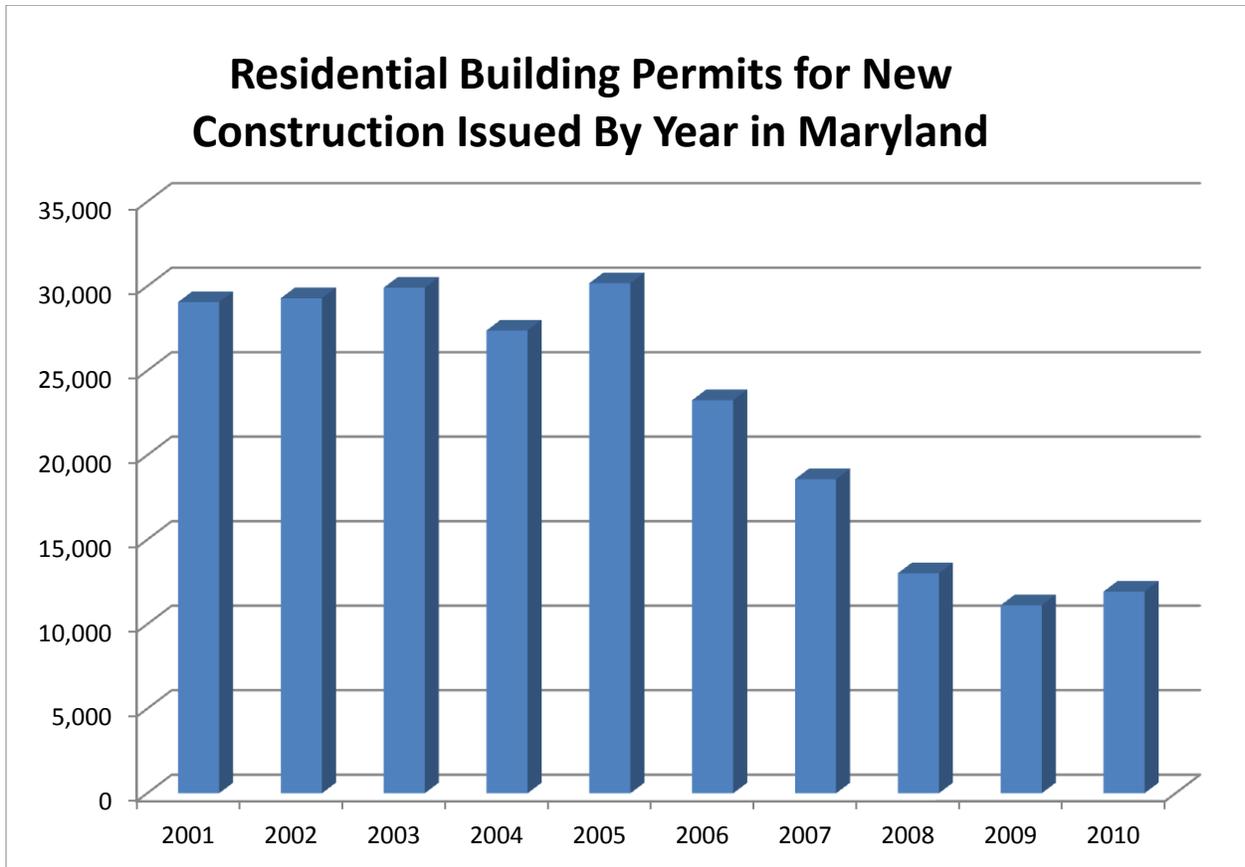


Figure 6. Permits by Year. Source: U.S. Census Bureau

Looking beyond new construction, residential addition and renovation projects account for a significant portion of all residential construction permits issued in the state. Based on interviews conducted with building officials in many jurisdictions throughout Maryland, and as illustrated in the chart below (figure 2), it is estimated that more than three-quarters of all residential building permits issued in these jurisdictions in 2011 were for additions or renovation projects.

Estimate of Residential Building Permits Issued in 2011

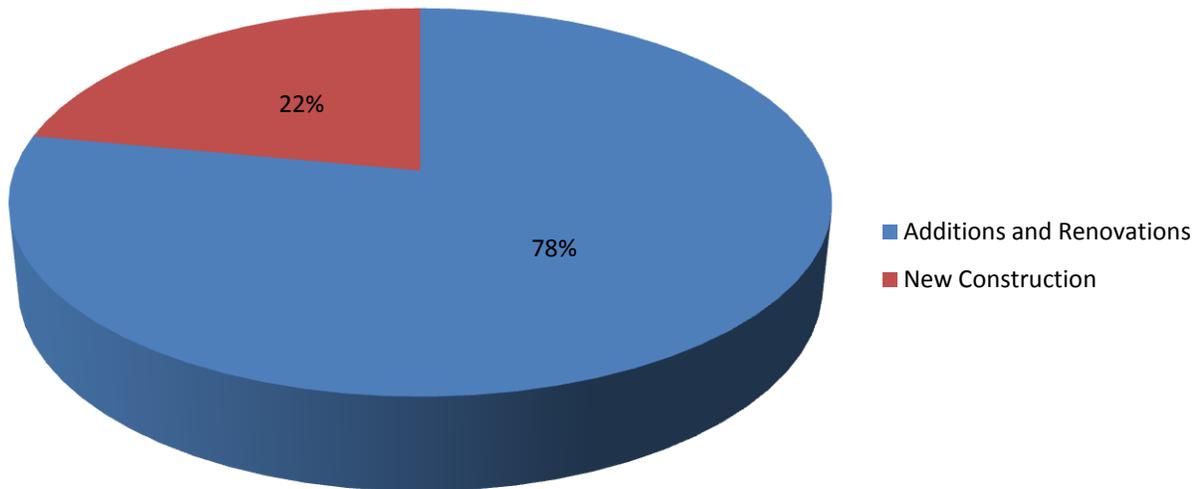


Figure 7. Permits by New Construction or Addition/Renovation

There is also a significant amount of commercial construction activity within the state. Based on a report published by the National Association of Office and Industrial Properties Research Foundation¹¹, the state of Maryland ranked eighth among all U.S. states in terms of the value of office construction put in place in 2010. According to this report, over \$530 million in hard costs were incurred in office construction during that year. In addition, in 2010, over \$240 million of hard costs were incurred on retail and entertainment related construction. From the interviews conducted with code officials in jurisdictions throughout the state, it is estimated that over 23,000 building permits were issued for commercial construction projects during 2011.

County and Municipality Code Official Interviews

During the development of this Plan, MEA interviewed code officials in jurisdictions throughout Maryland in order to gain insight into existing compliance with the state's energy code (see Figure 8). The interviews were based on a survey instrument developed by PNNL that establishes a baseline of compliance. Municipal building department staff with experience in oversight of residential or commercial building plan reviews and field inspections were targeted to ensure that the respondents have knowledge of the code compliance process. On average,

¹¹ The Contribution of Office, Industrial, and Retail Development and Construction to the U.S. Economy, NAIOP Research Foundation, 2011.

each interview lasted approximately fifteen minutes. The interviews were conducted by two individuals working collaboratively to ensure consistency of results.

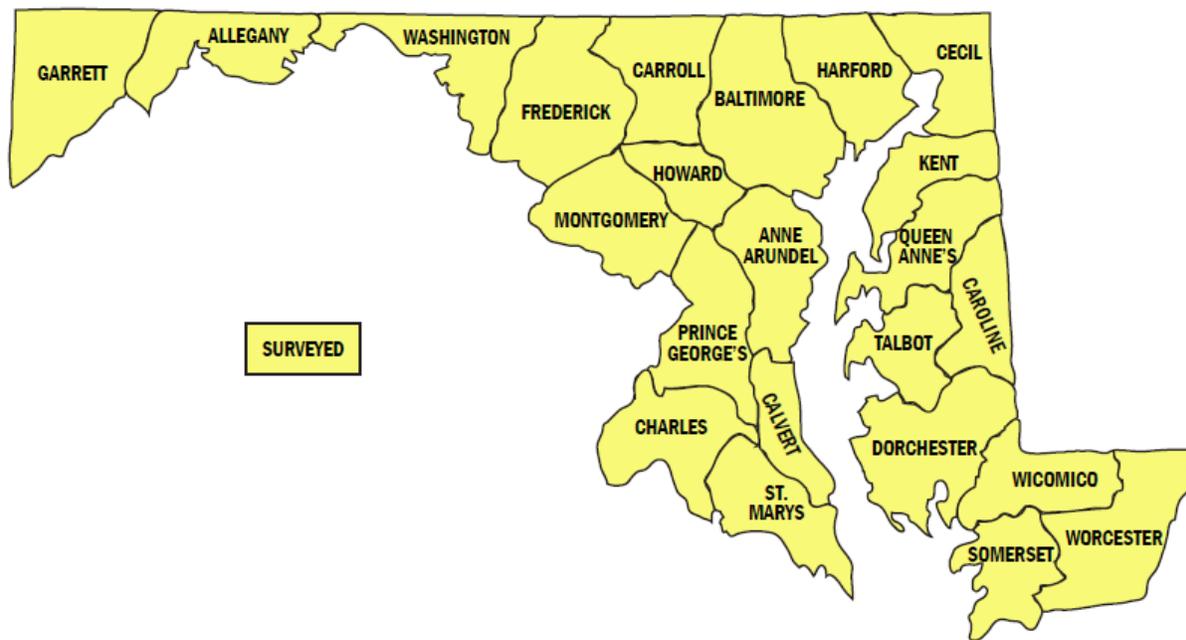


Figure 8. Counties Interviewed for the Report Shown in Yellow

Maryland is a home rule state and local jurisdictions are responsible for enforcement of the state building code. Each of the 23 counties in Maryland has adopted and enforces a version of the state building code. In addition, select municipalities in each county enforce their own building codes. A complete list of the municipalities with their own code enforcement office is unavailable, so MEA asked during each county interview if there were any municipalities within the county that enforce their own building codes. These municipalities were then added to the list of jurisdictions to be interviewed.

Interviews with code officials in all 23 counties in Maryland were completed and documented. In five counties, reliance on third parties to perform some or all enforcement functions was noted. In these cases, if both a county official and third party representative participated in an interview, their answers were combined into one interview for the jurisdiction. Of the 38 municipalities identified as enforcing their own building code, 12 municipalities completed interviews. Three of these 12 municipalities also use third parties for some or all enforcement functions. In addition, 11 identified municipalities indicate that they outsource plan reviews and field inspections for residential or commercial construction to a third party. In most cases, the third party was noted to be the Middle Department Inspection Agency (MDIA). MDIA is an independent inspection company that, among other things, provides building inspection and plan review services to municipalities. Insight was gained from MDIA in several jurisdictions, and due to concern that overly focusing on input from one organization might skew the results; several MDIA jurisdictions were not interviewed further.

Jurisdiction population estimates in the sample of interviewed officials ranged from 370 to almost one million. Residential permit numbers in these jurisdictions from the previous years ranged from 0 to 27,454, while commercial permits ranged from 0 to 10,000. It should be noted that the 27,454 was in Baltimore City where 89% of the permits were for additions or renovations. The next highest number of residential permits in a jurisdiction was 6,000.

In the jurisdictions interviewed, MEA discussed code compliance with several reviewers and/or inspectors employed by MDIA while conducting the county surveys. MDIA enforces the currently adopted codes for the county or municipality that hired them. An interview was also conducted with MDIA's regional director to garner a better understanding of the use of these third party reviews and inspections. MEA was told that each of its reviewers and inspectors obtain ICC certification and that their fees are paid by the builder, homeowner or general contractor. In some cases, jurisdictions rely on both in-house and third party enforcement staff.

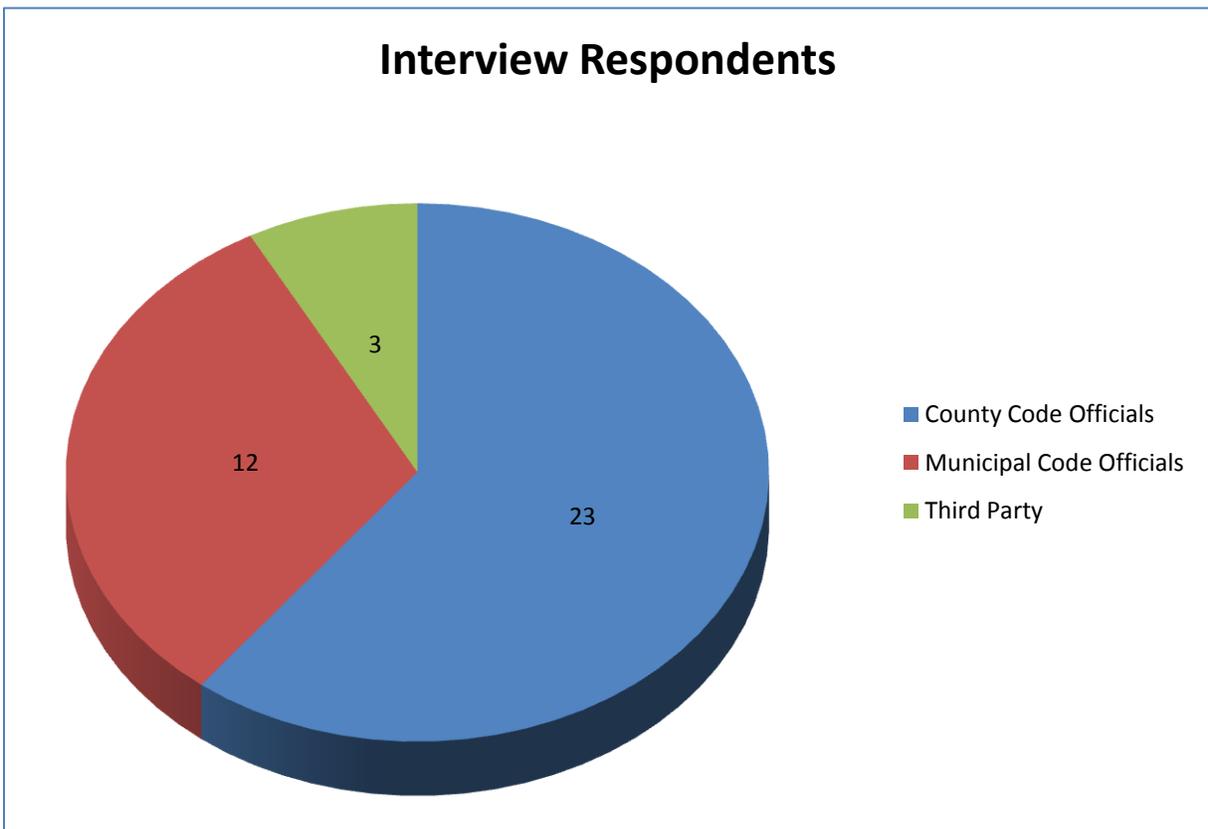


Figure 9. Interview Respondents

To assess the status of energy code adoption in the state, building code officials were asked what energy code their jurisdiction has in place and currently enforces. Almost three-quarters of the code officials note their jurisdiction is currently enforcing the 2009 IECC or 2012 IECC. However, most of the remaining code officials note that their jurisdiction is either operating under a pre-2009 version of the IECC or have not adopted an energy code. Similarly, over a quarter of all respondents note that there is no officially established timeframe for their jurisdiction to update its energy codes to align with a state energy code update.

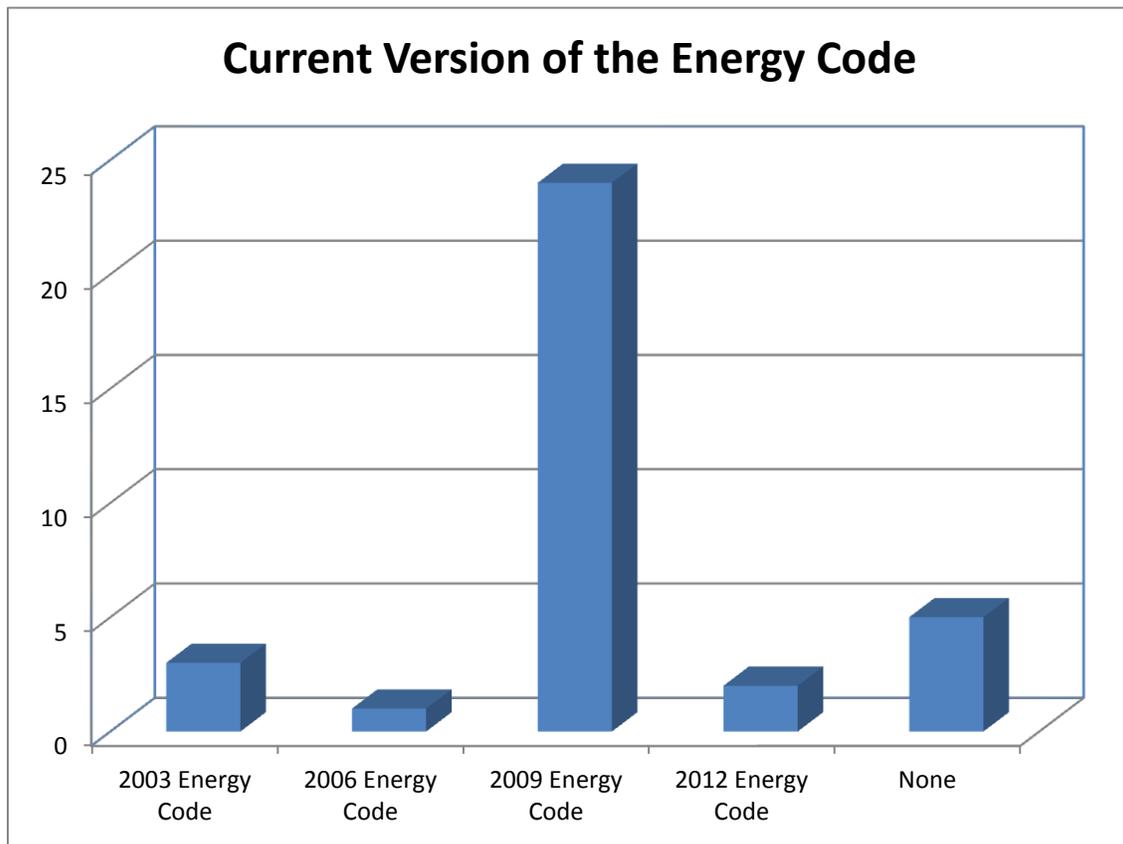


Figure 10. Energy Code Adoption

Building code officials, whose jurisdiction adopted the 2009 IECC or 2012 IECC, were asked to estimate what percentage of permitted construction within their jurisdiction complies with the 2009 IECC. Several code officials believe that 100% of the permitted constructed in their jurisdiction is compliant with the 2009 IECC and almost one-third feel that 90% complies. However, two out of the 26 building officials interviewed state that there is no way to determine the compliance level in their jurisdiction and that compliance could be anywhere from 0 to 100%. The nine officials in jurisdictions that had not adopted the 2009 IECC or 2012 IECC were not included in this question. It is important to note that five out of the seven most populous jurisdictions surveyed believe that at least 90% of permitted construction complies with the 2009 IECC.

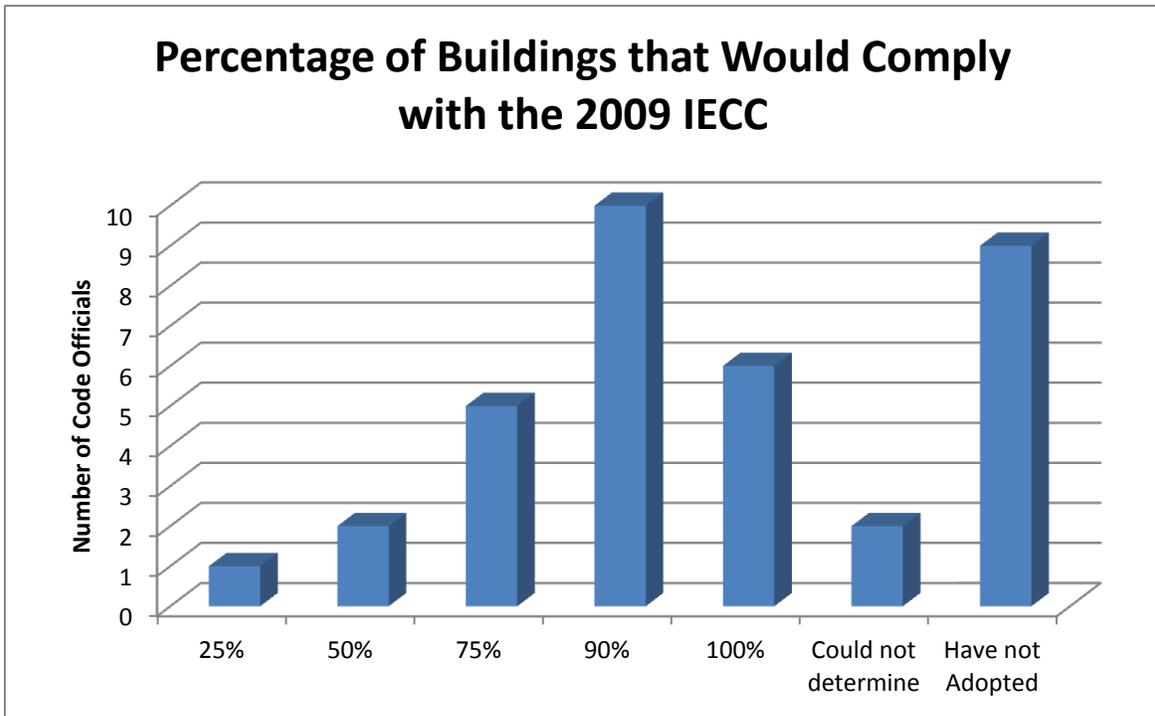


Figure 11. Compliance Percentage

Over 40% of the code officials surveyed report they have a high degree of training relative to the residential energy code. High-degree training is defined as that resulting in professional certification from the ICC or similar credentialing, and conducted on a regular basis. Most of the other respondents who did not receive a high degree of training on the residential energy code report receiving energy code training on at least a periodic basis.

When asked about the amount of training they receive on the commercial energy code, over 40% of the code officials surveyed note they receive a high degree of training. Most of the other respondents receive training on the commercial energy code on at least a periodic basis.

Many code officials perceive themselves to be adequately educated on the provisions of the residential and commercial energy code. A small number of code officials believe that a lack of education impedes them from adequately enforcing either the residential or commercial energy codes. The most common impediments identified are lack of time, funding, or other resources. (Participants often chose more than one impediment). During the interviews, code officials often connected a lack of funding and a lack of staff and time to enforce the energy code.

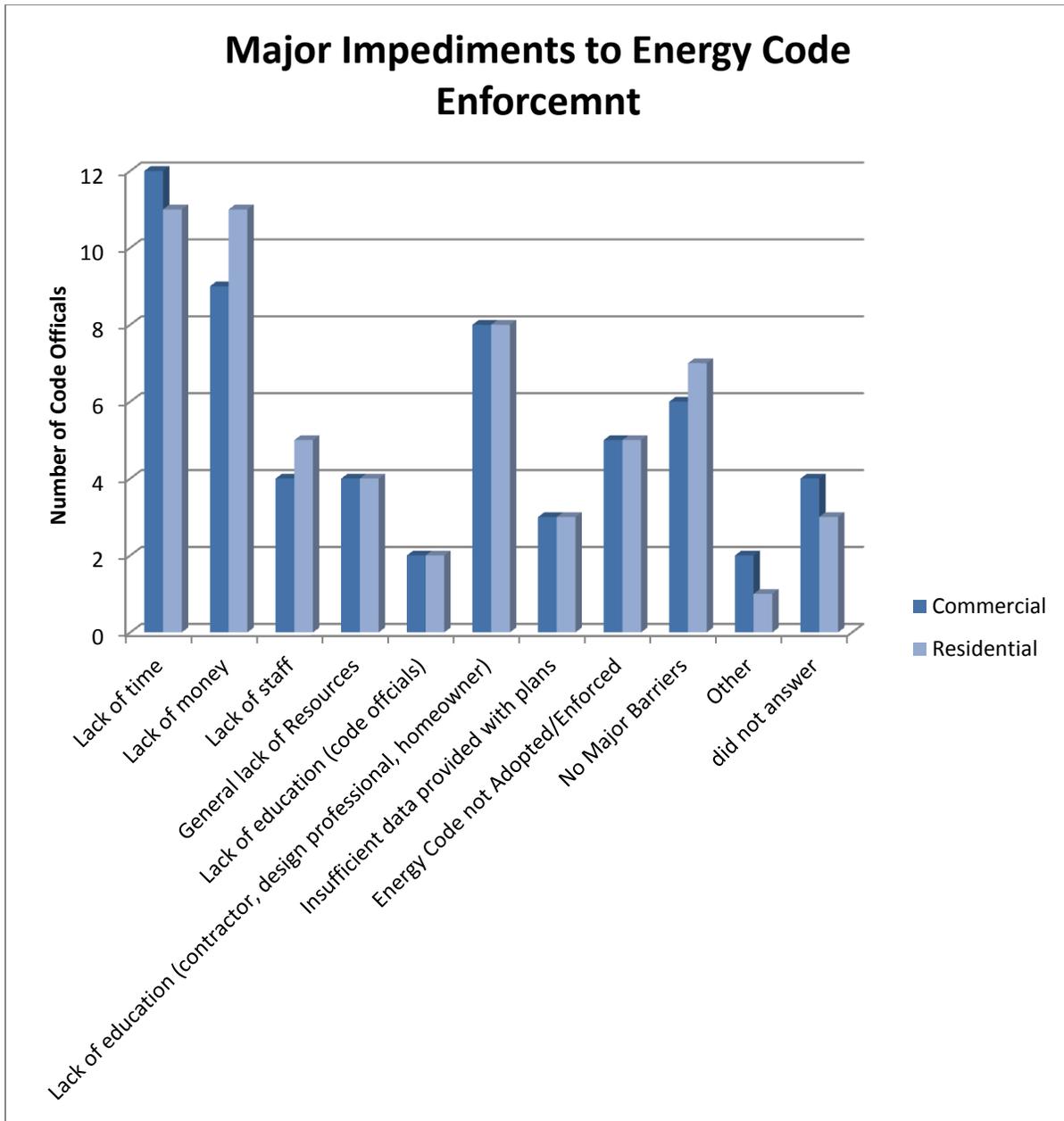


Figure 12. Impediments to Enforcement

Lack of training for contractors, design professionals, and the general public—along with a lack of time and money for code enforcement—appear to be major impediments to compliance with the energy code. Several code officials also point to inadequate plans from builders that provide insufficient information about energy code requirements. Code officials believe that ignorance of the energy code among contractors and design professionals places the burden of compliance on the code official. Officials suggest that additional training for contractors and design professionals will increase their understanding of the energy code and increase the likelihood that their work will meet the applicable provisions of the energy code. This will relieve

some of the burden on the code officials and increase efficiency of plan review and inspections. Lack of training only tells part of the story, however. Lack of funding in local departments, leading to a lack of staff, and therefore time to perform code verification appears to be the most commonly encountered barrier for code officials. Although the training strategy outlined above may alleviate some of this time burden, there still appears to be a lack of enforcement resources available to improve energy code compliance.

Due to this lack of resources, code officials indicate that they are only able to enforce the major elements of the energy code. When asked about the time spent on energy related items during plan review, as well as during field inspections, the average results range from just under three quarters of an hour to just over an hour for each activity.

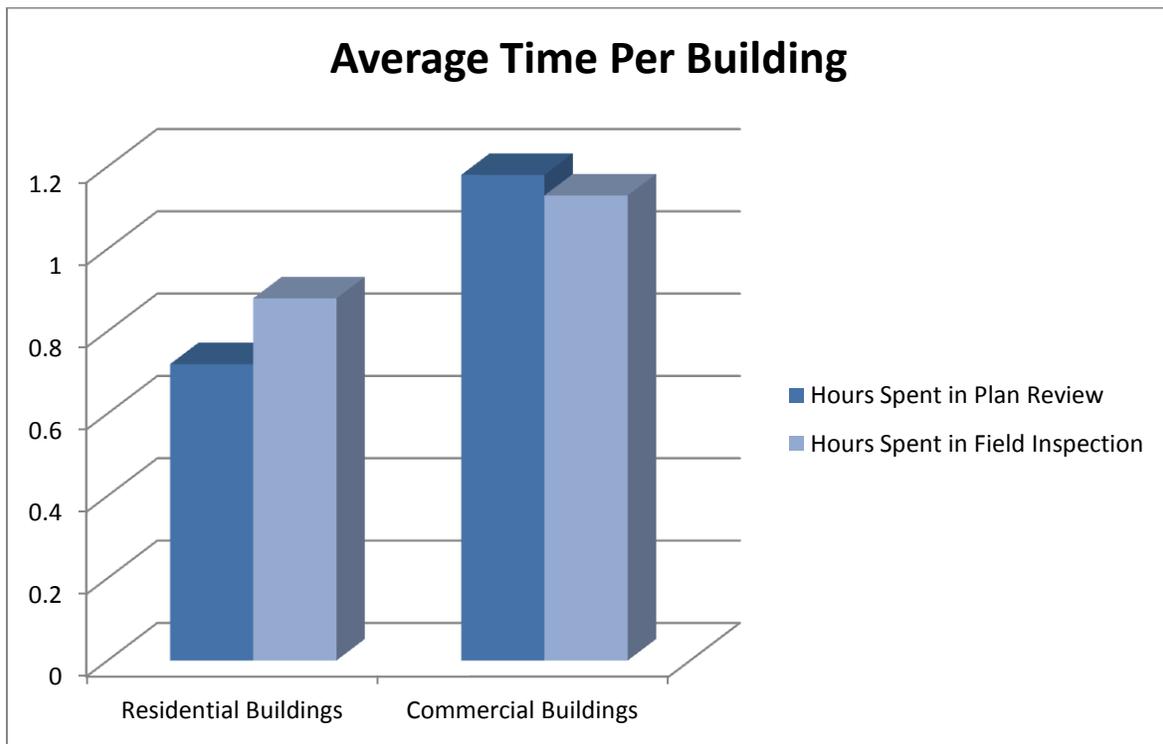


Figure 13. Average Enforcement Time

The greatest amount of time any official reported on commercial plan review is 8 hours and no other participant answered more than 3 hours. The greatest amount of time spent on residential plan review is three hours. The greatest amount of time spent on field inspection for either residential or commercial buildings is three hours.

Code officials were asked to identify plan review or inspection items that they generally find do not comply with the energy code in either residential or commercial buildings. For residential buildings, code officials noted the following as problematic:

- Envelope insulation installation
- Air sealing
- Duct insulation
- Duct sealing

On the commercial side, code officials most often noted envelope insulation installation and duct sealing as items typically found to be out of compliance with the energy code. Commercial buildings, more often than residential buildings, were identified as having no major items out of compliance.

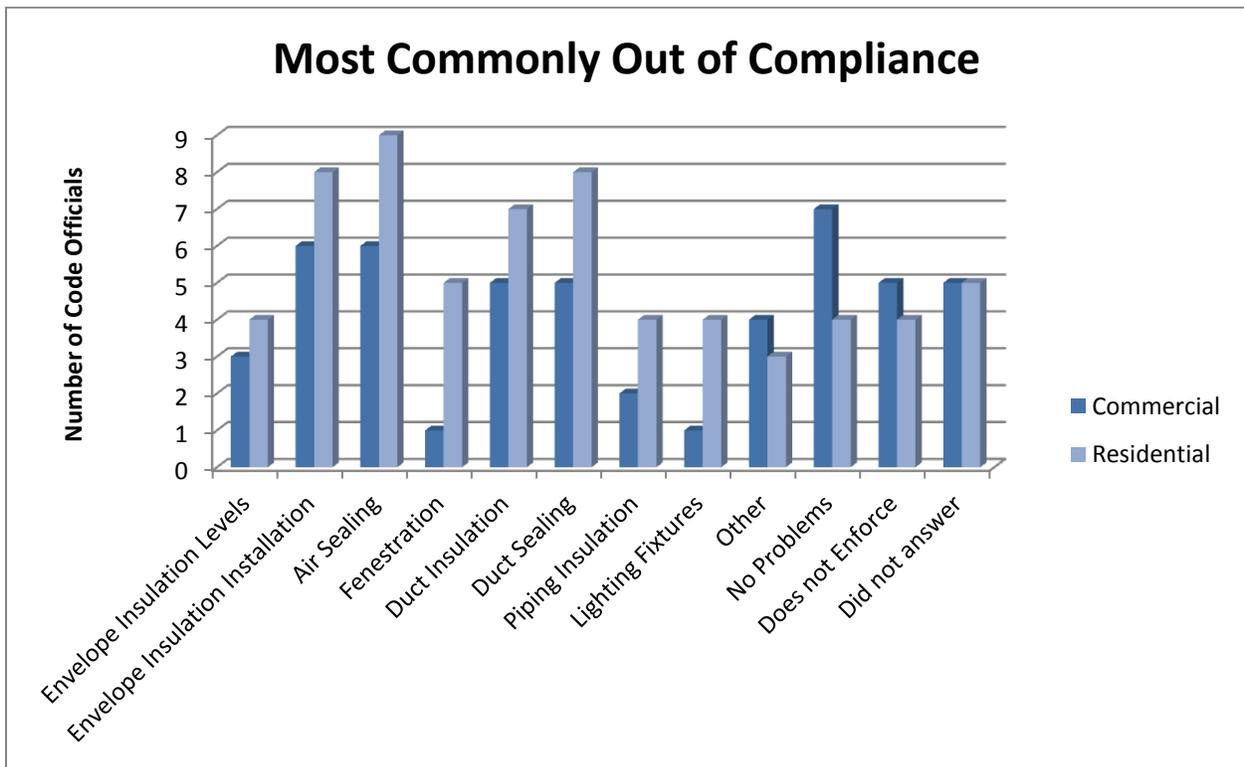


Figure 14. Common Compliance Problems

The findings from this question identify items that could serve as topics for education and training targeted at design professionals and contractors. However, when taken in the context of earlier responses that demonstrate the lack of time spent on plan review and field inspection, these responses may not fully capture the extent of compliance or non-compliance of buildings. For instance, a code official who doesn't review and inspect piping insulation or lighting fixtures may not indicate either of these as being out of compliance.

One of the questions in the survey asked code officials if their plan reviews and inspections cover all aspects of the energy code. Almost half of the code officials surveyed state that their plan reviews and inspections for residential and commercial projects do not cover all aspects of the energy code. Specific items were not disclosed, but it was often stated that due to time

constraints, officials are likely to cover most of the major elements of the code. When asked what information is typically missing from plans, specifications, or actual construction that precluded their ability to determine energy code compliance in residential and commercial buildings, code officials provided a number of different responses.

For residential construction, the responses include the following:

- RESCheck and the drawings don't usually match up
- Plans only include information concerning the major elements of the energy code
- Vapor barriers around fixtures
- Air Leakage Test Results
- Slab insulation details
- Insulation data
- Lighting
- Manual J calculations
- U-factor values for windows
- Energy code compliance checklists

For commercial construction, the responses include the following:

- COMCheck and the drawings don't usually match up
- Lighting
- Fenestration details
- Thermal breaks
- Insulation data
- Energy code compliance checklists

Code officials from some of the smaller counties and municipalities note that the handful of contractors that perform most of the work in their jurisdiction are familiar with what the code official requires as part of the review and construction process. This information could be misinterpreted as an indication of compliance. However, when understood in context of earlier discussions regarding a lack of time, energy aspects that the code official inspects as part of plan review may include only the general requirements of the energy code.

Major Survey Findings:

- Although a number of jurisdictions have adopted and are enforcing the 2009 or 2012 IECC, a number of other jurisdictions have not adopted it.
- Of those jurisdictions that have adopted the 2009 or 2012 IECC, some estimated that they have not reached 90% compliance with the energy code.

- Lack of money, time, and staff resources were most commonly identified as impediments to compliance, along with a lack of contractor and design professional training.
- Due to the abovementioned lack of resources, little time is spent by code officials on plan review or field inspection related to the energy code.
- In order to improve compliance, a broad array of strategies are needed including:
 - Local adoption of the energy code and greater commitment to enforcement
 - Greater resources available to code officials
 - Training for contractors and design professionals
 - Standardized approaches to plan review and inspections that are commonly understood by code officials, contractors, and design professionals; and
 - Better alignment of plan details and inspection checklists with the energy code.

Stakeholder Working Group

Section 3.1.1 of DOE's guidance on measuring compliance recommends the establishment of a code compliance working group made up of government and industry stakeholders in addition to other interested parties.¹² Following this advice, MEA began initial outreach to stakeholders, finding interested parties and arranging an initial meeting of the stakeholder working group on February 10, 2012. The minutes of this meeting are attached as Appendix A of this Plan. The object of this group in Maryland is to introduce the concept of improving and demonstrating energy code compliance, to further assess the current state of compliance in Maryland, and to gain input from stakeholders on major impediments to compliance, as well as to develop solutions.

¹² *Measuring State Energy Code Compliance*, Pacific Northwest National Laboratory, Prepared for The US Department of Energy, March 2010

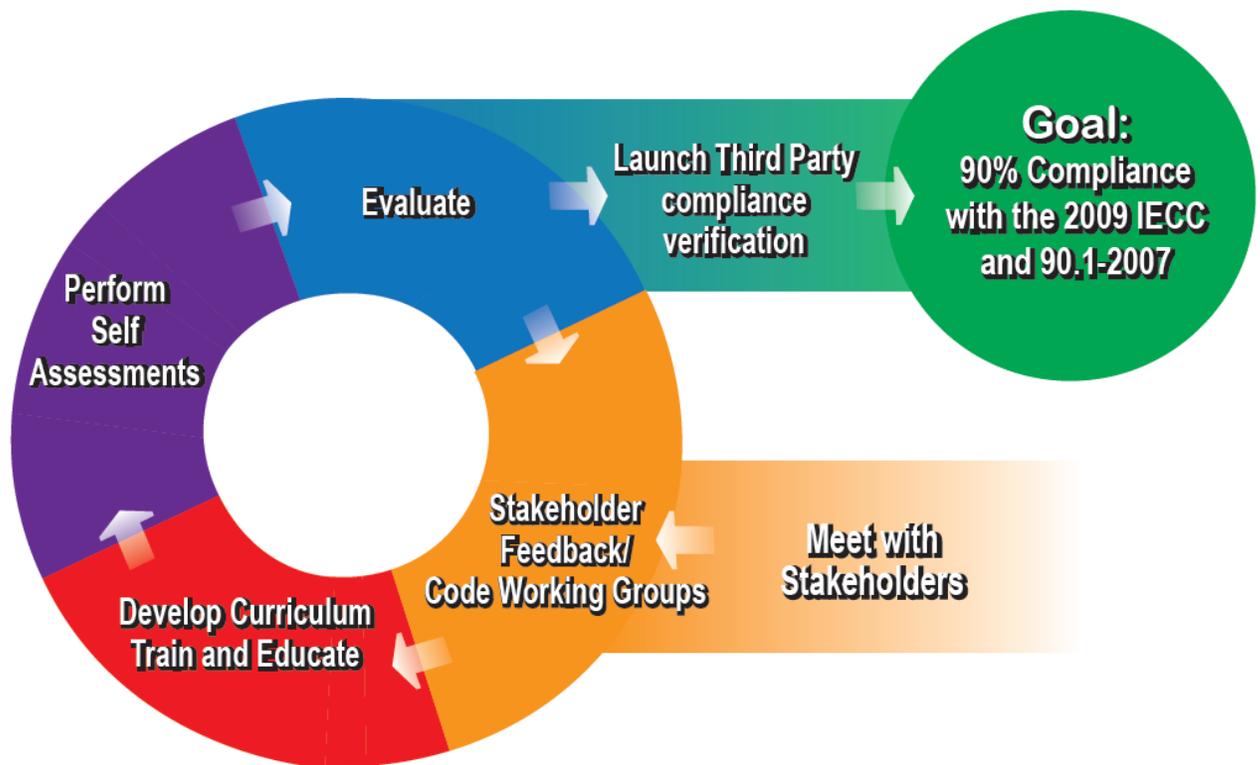


Figure 15. 90% Compliance Process

Participants in the working group meeting included multiple members of the Maryland Building Officials Association (representing several jurisdictions throughout the state); several building industry participants (including representatives from the Maryland National Capital Building Industry Association and the Frederick County Builders Association); and a local representative from the American Institute of Architects(AIA). A representative from the Building Code Assistance Project (BCAP) could not attend in person, but listened to the conversation via conference call. A representative from ACEEE was unable to attend but expressed interest in participating in future meetings. Despite ACEEE not being able to attend, MEA was able to gain valuable input through their annual *State Energy Efficiency Scorecard*, discussed elsewhere in this Plan. Finally, representatives from the Maryland Energy Administration, the Department of Housing and Community Development, as well as several MEA contractors, participated in the working group.

The first meeting of the stakeholder working group was well-attended and succeeded in bringing stakeholders together who are eager to contribute to the process of improving and demonstrating code compliance in the state. Major points of discussion included the need for education of stakeholders other than code officials, the energy code adoption process in

Maryland, a lack of enforcement resources, and the need for a standardized process and for standardized tools in plan review and field inspection.

The education discussion was important because it shifted focus away from the typical compliance approach of training code officials on the updates to the energy code (although this is still seen as an important step) and onto training of the public and other stakeholders. A major impediment to compliance identified by the working group was the lack of details provided by contractors and design professionals in site plan drawings for plan reviews. The working group felt that increased industry training would improve understanding of energy code requirements and therefore what details need to be included in plans. Inclusion of these details would then make both plan reviews and field inspections more accurate and improve time and resource efficiency. In addition, the working group indicated that better understanding of the code by industry would help builders to better achieve compliance in their building practices. Public education, in addition to industry education, was also a focus of the working group. This education would serve several purposes, including:

- Educating local decision-makers on the purpose of the energy code and the need for adequate enforcement;
- Educating homeowners/building owners on the purpose of the energy code and the benefits to them; and
- Educating do-it-yourself homeowners on how the requirements of the energy code apply to renovations that they perform.

This theme of improved education and information flow was mirrored in the code official interviews where all of these issues were brought up as impediments to compliance and enforcement.

Educating local decision-makers will be vital because there was extensive discussion on the energy code adoption process in Maryland. Despite the fact that Maryland law establishes a process for counties to adopt the state energy code within 6 months of state adoption, multiple counties interviewed have not yet adopted the 2009 IECC and are either not enforcing any energy code or had adopted the 2003 or 2006 IECC. In the jurisdictions that have adopted the 2009 IECC or 2012 IECC, there are questions about whether the code is being enforced or the extent to which the code was being enforced. A major driver in this situation is local decision-makers not adopting the state energy code as required and/or not allocating sufficient funds to adequately enforce the code.

A related point of discussion in the stakeholder working group included objections regarding the state-level energy code adoption process. Maryland policy is to adopt the latest version of the IECC within a year of publication. Several working group participants suggested a more in-depth review process before adopting a new energy code. This process could help establish the cost effectiveness of an energy code update, in addition to identifying unintended consequences of adoption. Members of the working group also asked for increased

stakeholder participation and access to the adoption process so that issues such as enforcement capabilities can be identified.

Connected to the discussion of local adoption of the energy code was a discussion of general lack of resources to enforce the code. In agreement with the interview responses, the top impediments to enforcement appear to be the lack of money, staff, and time to spend on energy code enforcement at the local level. To some extent, this could be improved through outreach and education to local decision-makers as mentioned above. However, in many cases, tools to make the enforcement process more efficient would help to better use the limited resources that are often available.

The tools discussed by the working group included a standardized process for plan review and inspection, in addition to standardized information submitted during plan review. Standardization would help ensure that complete energy code details are included in all plans and that these details can be easily verified in the field. To develop standardized tools and processes, the working group suggested holding a charette with code officials, design professionals, and contractors. This event could be used to identify and map out the most efficient way to organize and submit information to save code officials and industry partners' time and resources.

After a successful first meeting, MEA intends to assemble a formal working group and to continue reaching out to this working group to improve and measure energy code compliance in the state. Next steps for the working group will include reviewing and making suggestions on possible compliance self-assessment strategies, convening a charette to develop standardized processes and tools, and reviewing future state compliance reports.

Annual Self-Assessment

No clear method has been established for conducting an annual measurement or self-assessment process. In its *Measuring State Energy Code Compliance*, DOE states "There is no single methodology for conducting an annual measurement of code compliance." There are multiple approaches therefore that could be used, or combined, to form a comprehensive measurement strategy for the state. These approaches could be implemented individually by counties or municipalities, or could be facilitated by the state. These options include:

- High-level self-assessment could be performed by simply tracking jurisdiction adoption of the energy code.
- A centralized database for permit and plan review could be established with strong state quality assurance oversight. This database could also be populated with REScheck or COMcheck reports.
- Self-Assessment Survey – Building officials respond to a survey that serves to qualify a general level of knowledge, enforcement efforts, and overall compliance with the energy code. This could be performed following the interview model used by the state in the

baseline assessment study. In developing this Plan, building officials in most jurisdictions were easy to access and were willing to discuss compliance within their jurisdictions.

- Peer-to-Peer Assessment Survey – Through use of survey instruments, building officials rate compliance of the design professionals with the energy code (e.g., compliance documentation, site inspections), and design professionals rate the building officials' role in enforcing the energy code. Such a survey could be implemented through outreach to member organizations represented in the stakeholder working group.
- Round-Robin Plan Review – A round robin test is often used by organizations to assess the ability of multiple laboratories to produce consistent results. A similar concept could be employed to evaluate code officials' ability to conduct accurate plan reviews for energy code compliance. In such a review, a set of plans would be sent to building code officials along with a checklist of energy code requirements. The code officials would review the plans, and complete the checklist to identify which items are and are not compliant with the code. The results would then be scored to gauge building officials' overall ability to perform plan reviews. This would, by necessity, include multiple jurisdictions as some jurisdictions may have limited staff to conduct reviews.
- On-Site Inspection Exercise – An inspection exercise would involve having multiple building officials inspect an actual building for code compliance. Unlike a round-robin plan review, which would focus on compliance documentation only, an on-site inspection exercise would gauge building officials' ability to successfully inspect a building for compliance with the energy code. Building officials would fill out inspection checklists which would be scored to gauge their overall ability to perform site inspections.
- Building Equipment and Supplies Distributor Survey – By tracking and assessing the products which are being shipped within Maryland, it may be possible to gauge how often building products are compliant with the energy code. For example, comparing insulation and fenestration shipments' thermal performance ratings with the energy code's prescriptive U-factors and R-values would provide some level of compliance assessment. This method relies heavily on voluntary reporting by the industry, and the level of data detail may be insufficient to provide clarity on compliance (e.g., whether R-13 insulation that is shipped is used in walls or in ceilings).

These self-assessment and measurement strategies should be discussed with the Stakeholder Working Group for refinement and advice on implementation. The state or local jurisdictions could choose the same approach or implement the best approach for each jurisdiction.

Findings and Recommendations

Finding #1: Stakeholders want to be involved in the process. Code officials, builders, and architects all responded positively and were able to convene on a relatively short timeframe to participate in a meeting on reaching 90% compliance. Stakeholder involvement is key to not only meet the 90% compliance test but to help Maryland meet its long-range energy planning goals.

Recommendation #1: Use the stakeholder group assembled for the initial meeting as the stakeholder working group going forward with the addition of the following:

- Maryland Association of Counties;
 - Maryland Municipal League;
 - Trade contractors from the residential sector;
 - Trade contractors from the commercial sector; and
 - Architects and builder representation from commercial and residential sectors as well as remodelers.
-

Finding #2: Although code officials seem to be knowledgeable about the requirements of the 2009 code, there appears to be a need to continue education as well as to focus education on additional stakeholders. With the continuing advancement of the energy code education will remain a priority.

Recommendation #2: Training and education should focus more on small groups and be more interactive. There should be less focus on what is contained within the code and more on how to implement the code requirements for various stakeholders. Examples of more directed education for stakeholder groups include:

- Training for code officials that highlights plan review, COMcheck and REScheck reports, field inspections, significant areas of non-compliance, etc.
- Training for contractors on building systems and installation details to allow for non-prescriptive compliance options.
- Training for design professionals on energy details that need to be included in drawings for plan review.
- Focused education efforts directed to local decision-makers that stresses the importance of the energy code and on how to implement cost-saving, streamlined compliance processes. Education should also include an emphasis on the financial resources needed to ensure compliance.

All education and outreach efforts should be focused on the most recent code adopted by Maryland.

Finding #3: Code adoption and enforcement varies widely across the state. Although a number of jurisdictions have adopted and are enforcing the 2009 or 2012 IECC, a number of other jurisdictions have adopted either earlier versions or no energy code at all. Compliance rate estimates ranged from no enforcement and little knowledge of compliance to expectations of high compliance rates with the energy code. Sixteen out of 35 jurisdictions interviewed believe that they have already reached 90% compliance or better.

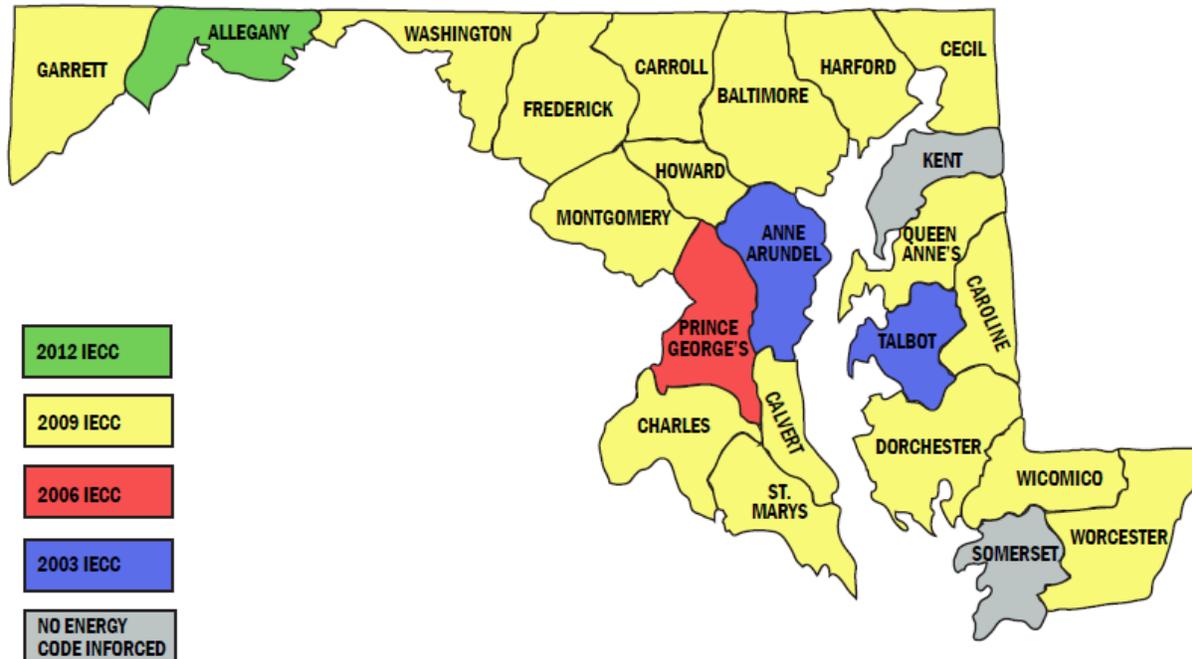


Figure 16. Code Adoption by County

Recommendation #3: Develop a revised compliance approach based on current realities in the state. A county-by-county approach could be developed with the most compliant counties testing out early. Several different models could be developed and discussed within the stakeholder/code working group. The proposed approach would then be submitted to DOE/PNNL. The approach would keep in mind the elements of the statistical analysis recommended by BECP for demonstrating 90% compliance:

- One-sided confidence interval
- Upper confidence bound as a function of population mean, standard deviation, and number of samples
- Samples are “distributed” or “weighted” based on climate zones, building type, and building starts at the county level
- A sample generator tool is available that lists the total number and type of buildings that should be sampled for each county
- BECP recommendation that the formal evaluation is of a single population within a one-year time period.¹³

If an alternative approach based on current realities is used it could have considerable benefits:

- Maryland’s leadership position would be enhanced by addressing the state’s compliance early in the process.
- Resources could be targeted to areas with greatest need.

¹³ Ibid.

- Confusion on the version of the energy code being tested would be reduced.
 - The fact that some jurisdictions could pass early might be an incentive for others. They could serve an advocacy or mentoring role for other jurisdictions.
 - The jurisdictions that have passed would not need to submit the annual reporting, freeing up resources for moving forward with implementing more advanced codes.
-

Finding #4: There is currently no clear guidance from DOE/PNNL on the methodology for the self-assessments or annual surveys. States are just starting to address this issue. This Plan suggests a number of different approaches that could be considered.

Recommendation #4: Develop three or more clearly defined approaches, discuss them with the stakeholder/code working group, and revise accordingly. Test the methodologies with one or more willing counties prior to implementation.

Finding #5: Of the jurisdictions that adopted the 2009 or 2012 IECC, some felt they were significantly short of 90% compliance. The reasons for non-compliance were fairly consistent across jurisdictions with many building officials pointing to a lack of money, time, and staff resources (all of which point to resource constraints) as well as inadequate knowledge among architects and building professionals as reasons for non-compliance.

Recommendation #5: Have each of these jurisdictions conduct a self-audit. Address areas of non-compliance through focus groups, education, and outreach. For example, if incomplete plans are a problem, conduct a charette involving architects and code officials to address the issue. Develop a strategy and implement it through AIA and other appropriate stakeholder groups to correct the problem.

Finding #6: Of the 35 jurisdictions interviewed, nine were either using a pre-2009 energy code edition or had no energy code at all.

Recommendation #6: Through meetings and/or in-depth interviews develop an understanding of why each of these jurisdictions has not adopted a more recent energy code. Once the reasons are understood, create and implement a strategy to help them adopt and enforce the 2012 code. This help could come in the form of standardized compliance checklists; links to third-party inspectors; or, in the case of municipalities and reliance on the county for energy code enforcement.

Finding #7: The stakeholder working group which convened in February 2012 identified the need to involve and educate consumers. This Plan does not include any survey or interview

data to test the knowledge level of consumers. However, it is widely acknowledged that consumers can have a large impact on energy efficiency. This is particularly true in energy compliance with residential remodeling activities. The costs and benefits of customer and public education are hard to quantify, but it is commonly accepted that energy efficiency education is valuable and necessary. Public education is an important part of market transformation and can make codes, standards, and programs more effective.¹⁴

Recommendation #7: Develop and test marketing information to educate consumers on energy efficiency and the code requirements. Develop and outreach plan and implementation strategy.

¹⁴ Discussion of Consumer Perspectives on Regulation of Energy Efficiency Investments, McKinsey and Company, 2009.

Appendix A – Stakeholder Working Group Meeting Minutes

Appendix B – Letter from the Governor

Appendix C – Code Official Interview Guide